Measuring the value of an urban active environment, using the WHO health economic assessment tool (HEAT)

Edited by: Cavill, Nick ; Kahlmeier, Sonja ; et al

SPACE

Supporting Policy and Action for Active Environments

MEASURING THE VALUE OF AN URBAN ACTIVE ENVIRONMENT, USING THE WHO HEALTH ECONOMIC ASSESSMENT TOOL (HEAT)

www.activeenvironments.eu

Co-funded by the
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INTRODUCTION

Introduction to the SPAcE Project

Supporting Policy and Action for Active Environments (SPAcE) is a collaborative three year European project co-funded by the Sport: Collaborative Partnerships action of the Erasmus+ Programme.

The project links together 10 project partners from 8 different EU countries to achieve the objective of developing sustainable active urban environments in cities and towns across the EU.

The overall aim of the SPAcE project is to make the healthy choice the easy choice through creating healthy urban environments. SPAcE aims to increase the physical activity level of the communities involved in the project, and support and encourage social inclusion through more active participation.

Aim of this document

The aim of this document is to offer guidance for the estimation of the economic benefits of walking and cycling using the World Health Organization's Heath Economic Assessment Tool (HEAT). The document aims to complement existing HEAT materials which include a comprehensive user guide, free online training and the tool itself, which can be accessed at http://heatwalkingcycling.org/

This document presents five case studies from the SPAcE project which demonstrate how HEAT can be used by organisations who want to assess the impact of potential increases in walking and cycling in their communities.

This document is the third of a series of three outputs from the SPAcE project. It complements:

- **Environment for Physical Activity in Europe – A Review of Evidence and Examples of Practice** (Cavill, 2017)
- **How to create an Urban Active Environment (UActivE) Action Plan: Lessons learnt from the SPAcE project including case study examples** (Crone et al., 2017).

Overview of HEAT

What is HEAT?

The Health Economic Assessment Tool (HEAT, http://www.heatwalkingcycling.org) is an online tool to estimate the benefit in terms of reduced mortality as a result of walking or cycling in a population.

It has been developed by a panel of experts, coordinated by the World Health Organization and it is based on up to date research knowledge on the health effects of physical activity.

What can HEAT be used for?

HEAT is designed to be used in three main ways:

- To assess the economic benefit of current levels of cycling or walking
- To assess the economic benefit of an intervention that increased cycling or walking
- To assess the economic benefits of potential hypothetical increases in cycling or walking

What are the calculations behind HEAT?

HEAT uses published data on the relative risks of all-cause mortality for walking or cycling, and applies these to the volume of walking or cycling in the study area, to estimate the potential reduction in death rate. It then assigns an economic value on the reduced all-cause mortality using the 'value of a statistical life' (VSL).

What sort of data is required?

Depending on the purpose of the assessment, data can be from a single point of time (e.g. current cycling levels) or before and after data (e.g. cycling levels before and after the introduction of a cycling lane).

The users needs to provide data for the average length of cycling or walking (in time duration, distance covered, steps or trips) and an average frequency (per day/week/ or month).

Are there any limitations in the use of HEAT?

HEAT does not provide estimations for younger people (< 20 years old) or for individuals or small groups of people.

Are there any step-by-step examples of HEAT studies?

This document presents five case studies from the SPACE project. These are presented in the form of a step-by-step guide to assist with the implementation of HEAT in other settings. The Appendix presents further studies that outline the steps taken for a HEAT related assessment.

How can I learn more about HEAT?

There are a number of resources which are free to access and download from the HEAT website (http://heatwalkingcycling.org) including a user guide, examples and free online training. These provide an inclusive methodological guidance, reviews of the scientific evidence and instructions for the user.

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CASE STUDIES USING HEAT

Case Studies Using HEAT

In the SPACE project, partners worked on action plans that set out a range of actions that they proposed to take in their towns to improve the environments for walking and cycling. Part of this process involves advocacy for walking and cycling: persuading local (and perhaps national) decision-makers that they should invest in walking and cycling, and that such investments would be worthwhile. This is where the HEAT proved to be particularly useful, as it enabled case study sites to put an economic value on any increases in walking and cycling that might arise from their actions. The SPACE case study sites and their use of the HEAT are summarised below in Table 1, and case studies of their use of HEAT follow.

Table 1. Overview of HEAT Case Studies

Case study	Country	Focus of HEAT	Setting	Approach
1. Trikala	Greece	Cycling	City	Estimating the effects of current situation and projections
2. Tukums	Latvia	Cycling	City	Projection
3. Brasov	Romania	Cycling	City	Estimating the effects of current situation and projections
4. Toledo	Spain	Cycling	City and Suburbs	Projection
5. Palermo	Italy	Walking	City	Projection

Case study 1: Trikala, Greece

Overview

Trikala is a city in central Greece. The Municipality of Trikala consists of the city of Trikala and another 39 small settlements. It covers a total area of 608 square kilometres, with a population of around 75,000.

Trikala's Action Plan focused primarily on increasing cycling through investing in cycle infrastructure.

Assessment of the economic impact of current cycling at the city of Trikala

The Municipality of Trikala set out to assess the economic impact of the current level of cycling in Trikala, as well as estimations of the economic impact of future increases of cycling due to the Municipality's stated policy and planned infrastructure development.

Data Collection and handling

The Municipality conducted a survey in September 2016 to provide data for the HEAT assessment and to support the development of their action plan. The Municipality collected 360 print and 198 online questionnaires from citizens of Trikala. These covered a range of themes such as perceptions of current state of cycle paths; preferences for expansion; perceived ease of moving by bicycle; perceived usefulness of more footpaths; etc. These data will be used to support the development of policies to enhance active commuting. The survey also asked how many days per week people cycled, and distance travelled on an average day. From the 558 respondents, 255 were retained (after excluding those not between 20 and 64 years of age, those who do not have a bike, and those that use their bike less than once per month). This sample reported a mean days cycling per week 5.04

and a mean distance covered per day 1.8km. It was estimated that people who used their bike in the city did so on 200 days per year on average – taking into account the weather conditions in Greece.

Population data came from the most recent (2011) available data of the Greek Census Bureau provide a number of 33,349 persons living in the City of Trikala aged between 20 and 65. A national survey of bicycle use (2012) indicated a 15% daily usage in the Region of Thessaly (compared to an overall 2.5% for Greece). Based on the above data, the number of current cyclists at Trikala was estimated at 5,000. Entering these data in the HEAT Tool provided a calculation of the economic impact of current cycling. The economic benefit of current cycling in 10 years will be 7,475,000 euros. Further projections were calculated in line with the Municipality's proposed goals for increasing cycling. These are shown below, with results from the HEAT assessments. Table 2 shows the detailed specifications for the baseline assessment and the three projections. It is intended that these results will be used by the Municipality to estimate the cost-benefit ratio for developing cycling infrastructure.

Projection 1: If the Municipality increases the number of cyclists by 3% the economic benefit over 10 years will be €8,970,000

HEAT estimate

Reduced mortality as a result of changes in cycling behaviour

The cycling data you have entered corresponds to an average of 366 km per person per year.
This level of cycling provides an estimated protective benefit of: 3% (compared to persons not cycling regularly).
From the data you have entered, the number of individuals who benefit from this level of cycling is: **6000**.
Out of this many individuals, the number who would be expected to die if they were not cycling regularly would be: **14.31**
The number of deaths per year that are prevented by this level of cycling is: less than 1

Economic value of cycling

Currency: EUR, rounded to 1000

The value of statistical life applied is:	**2,691,000 EUR**
The annual benefit of this level of cycling, per year, is:	**1,162,000 EUR**
The total benefits accumulated over **10** years are:	**11,617,000 EUR**
When future benefits are discounted by **5%** per year:	
the current value of the average annual benefit, averaged across 10 years is:	**897,000 EUR**
the current value of the total benefits accumulated over 10 years is:	**8,970,000 EUR**

Projection 2: If the Municipality helps increase the mean distance cycled by 500m the economic benefit over 10 years will be €9,395,000

HEAT estimate

Reduced mortality as a result of changes in cycling behaviour

The cycling data you have entered corresponds to an average of **460.00 km** per person per year.
This level of cycling provides **an estimated** protective benefit of: 4% (compared to persons not cycling regularly).
From the data you have entered, the number of individuals who benefit from this level of cycling is: **5000.**
Out of this many individuals, the number who would be expected to die if they were not cycling regularly would be: **11.93**
The number of deaths per year that are prevented by this level of cycling is: less than 1

Economic value of cycling

Currency: EUR, rounded to 1000

The value of statistical life applied is: **2,691,000 EUR**	
The annual benefit of this level of cycling, per year, is:	**1,217,000 EUR**
The total benefits accumulated over 10 years are:	**12,167,000 EUR**
When future benefits are discounted by **5%** per year:	
the current value of the average annual benefit, averaged across 10 years is:	**940,000 EUR**
the current value of the total benefits accumulated over 10 years is:	**9,395,000 EUR**

Projection 3: If the Municipality increases the number of cyclists by 3% AND increases the mean distance cycled by 500m the 10 year economic benefit will be €11,274,000.

HEAT estimate

Reduced mortality as a result of changes in cycling behaviour

The cycling data you have entered corresponds to an average of 460.00 km per person per year.
This level of cycling provides an estimated protective benefit of: 4% (compared to persons not cycling regularly).
From the data you have entered, the number of individuals who benefit from this level of cycling is: **6000**.
Out of this many individuals, the number who would be expected to die if they were not cycling regularly would be: **14.31**
The number of deaths per year that are prevented by this level of cycling is: less than 1

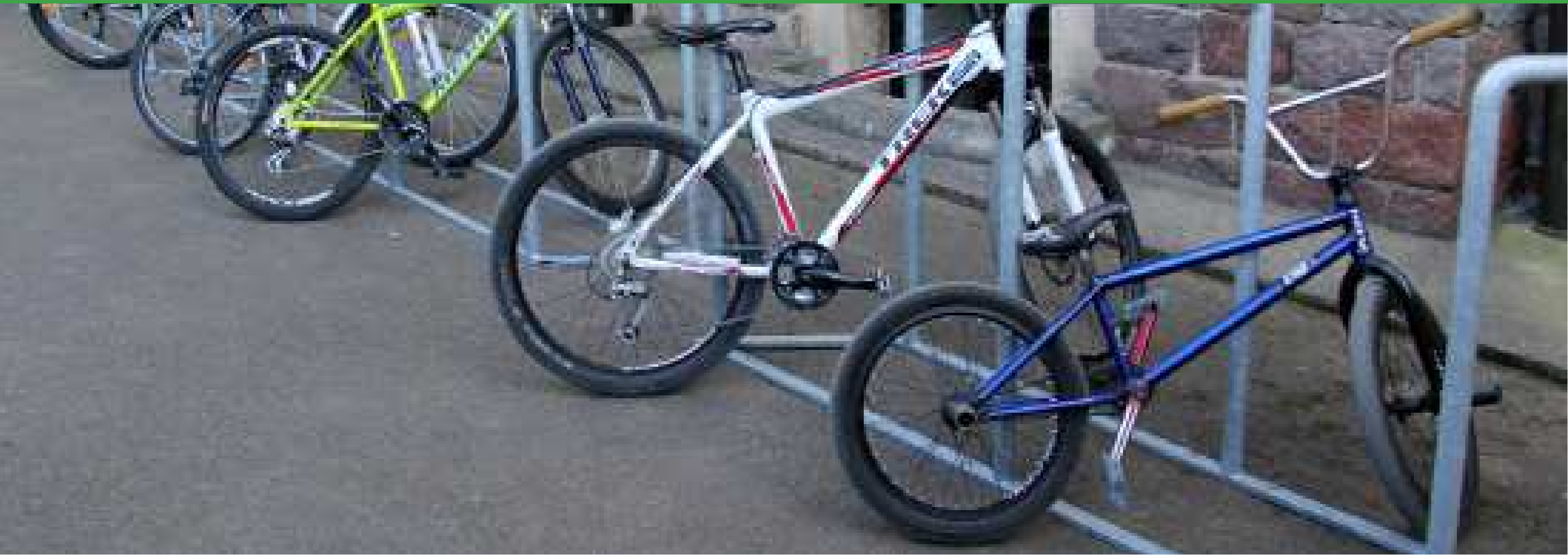
Economic value of cycling

Currency: EUR, rounded to 1000

The value of statistical life applied is: **2,691,000 EUR**	
The annual benefit of this level of cycling, per year, is:	**1,460,000 EUR**
The total benefits accumulated over **10** years are:	**14,601,000 EUR**
When future benefits are discounted by **5%** per year:	
the current value of the average annual benefit, averaged across 10 years is:	**1,127,000 EUR**
the current value of the total benefits accumulated over 10 years is:	**11,274,000 EUR**

Table 2: Step-by step HEAT specifications for Trikala case study

	Baseline	Projection 1	Projection 2	Projection 3
Physical Activity Mode	Cycling	Cycling	Cycling	Cycling
Single Point of time/ Before After and Intervention	Single Point	Single Point	Single Point	Single Point
Type of Data	Distance	Distance	Distance	Distance
Average distance cycled	1830m	1830m	2300m	2300m
Days per Year	200	200	200	200
How many people benefit?	5000	6000	5000	6000
Current cycling or effects of intervention	Current Cycling	Current Cycling	Current Cycling	Current Cycling
Mortality Rate for Age range	20-64	20-64	20-64	20-64
Mortality Rate for Country	Greece	Greece	Greece	Greece
VSL for	Greece €2,690,703	Greece €2,690,703	Greece €2,690,703	Greece €2,690,703
Currency	Euro	Euro	Euro	Euro
Time period (Years)	10	10	10	10
Benefit Cost Ratio	No	No	No	No
Discount Rate	5%	5%	5%	5%
Current Value of Annual Benefit	€748,000	€897,000	€940,000	€1,127,000



Case study 2: Tukums, Latvia

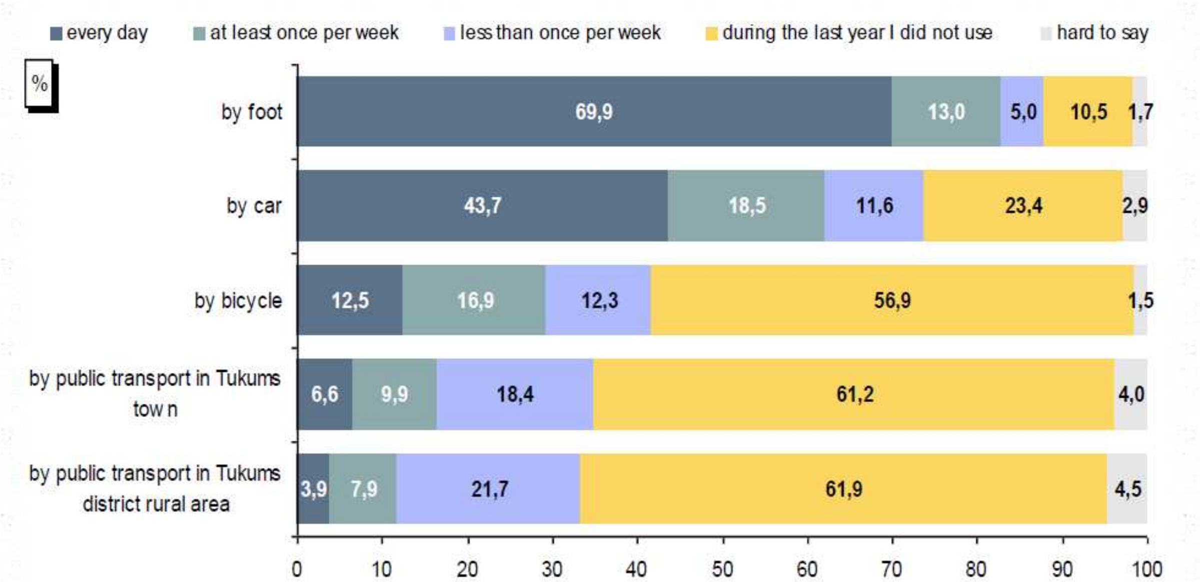
Overview

Tukums is a small town in Latvia. In Tukums, the HEAT was used for general advocacy purposes, to persuade decision-makers to invest in cycling and walking by demonstrating the economic benefits of increased levels of cycling and walking across the city.

Data collection

In 2016, the research centre SKDS conducted a population survey: "Assessing the performance of Tukums municipality services". Figure 1 shows the transport modal splits in the city

Figure 1. The different transport modes of the population in Tukums, 2016. (n=405)



The survey showed that:

Cycling

- 12.5% use their bicycle every day;
- 16.9% use it at least once a week,
- 12.3% use it less than once per week

Walking

- 69.9% walk every day
- 13% walk at least once per week
- 5% walk less than once per week

The working age population of Tukums in 2015 was 17,887 [1].
It was decided that a focus on cycling would be more likely to produce figures that were useful for advocacy purposes.

Using the proportions from the study and the population figures from Tukums showed that:

- 2,236 people say they cycle every day (12.5% of 17,887)
- 3,023 people say they cycle at least once a week (16.9% of 17,887)
- 2,200 people say they cycle less than once a week (12.3% of 17,887)

So in total there are 7,459 people who say they cycle between 'less than once a week' and 'every day' in Tukums. It was thought that these figures for everyday cycling seems on face value to be too high: it is unlikely that there are over 2,000 people cycling every day in the town.

It was therefore decided to calculate the benefits based on the following scenario:

What would be the value of persuading everyone who has a bike and cycles at least occasionally in Tukums, to cycle 3 times a week?

We did not have data for the length of each trip so was assumed they were average length of 3km.[2] This means that on a cycling day, the person cycled on average a total of 6km (i.e a return trip of 3km each way).

1 Data source: Tukums Municipality

2 https://ec.europa.eu/transport/road_safety/specialist/knowledge/pedestrians/pedestrians_and_cyclists_unprotected_road_users/walking_and_cycling_as_transport_modes_en

This gave the following calculations using the HEAT:

HEAT estimate

Reduced mortality as a result of changes in cycling behaviour

The cycling data you have entered corresponds to an average of 936 km per person per year. This level of cycling provides **an estimated** protective benefit of: 8% (compared to persons not cycling regularly).
From the data you have entered, the number of individuals who benefit from this level of cycling is: **7459**.
Out of this many individuals, the number who would be expected to die if they were not cycling regularly would be: **42.90**
The number of deaths per year that are prevented by this level of cycling is: 3

Economic value of cycling

Currency: EUR, rounded to 1000

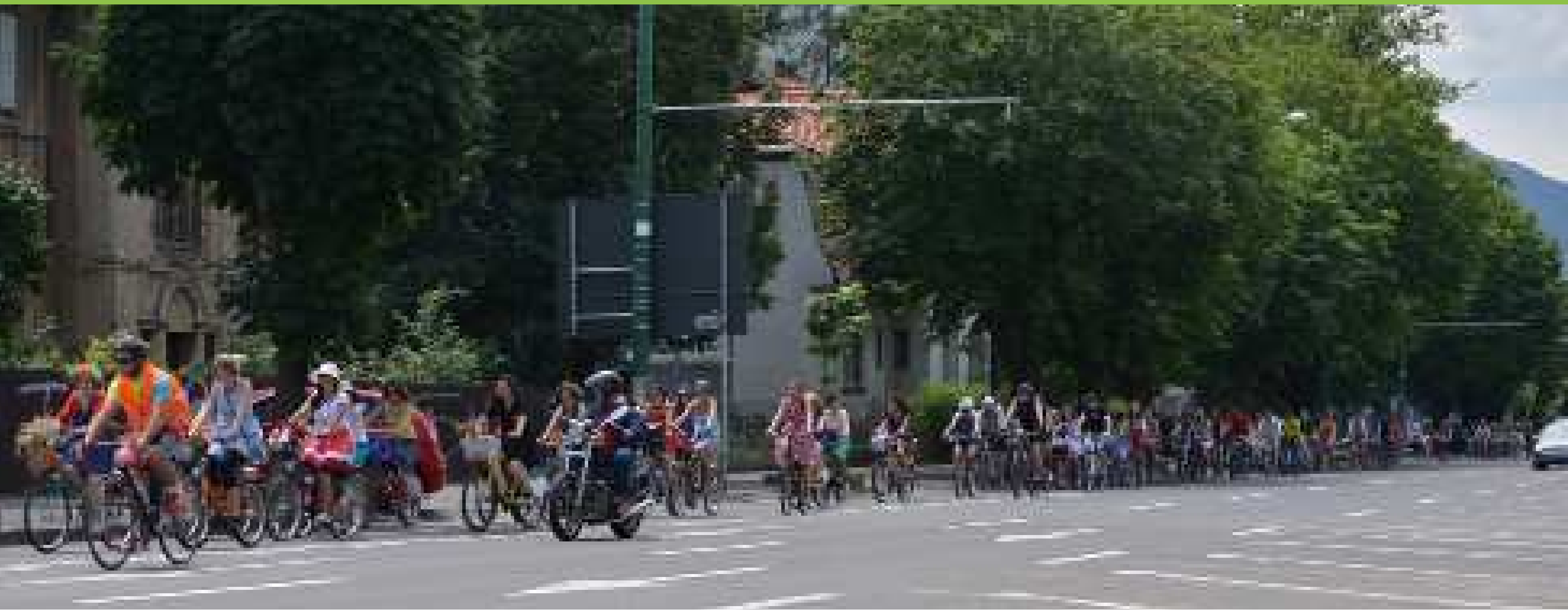
The value of statistical life applied is: **981,000 EUR**	
The annual benefit of this level of cycling, per year, is:	**3,246,000 EUR**
The total benefits accumulated over **10** years are:	**32,462,000 EUR**
When future benefits are discounted by 5% per year:	
the current value of the average annual benefit, averaged across 10 years is:	**2,507,000 EUR**
the current value of the total benefits accumulated over 10 years is:	**25,066,000 EUR**

So, in conclusion ***In Tukums, if we targeted only people who have cycled in the last year, and encouraged them to cycle three times a week, we would save three lives per year. This is valued at €2,5m per year.***

Table 3: Step-by step HEAT specifications for Tukums case study

Tukums	
Physical Activity Mode	Cycling
Single Point of time/ Before After and Intervention	Single Point
Type of Data	Distance
Average distance cycled	6km
Days per Year	156 (3 times a week)

How many people benefit?	7,459
Current walking or effects of intervention	All current cycling
Mortality Rate for Age range	20-64
Mortality Rate for Country	Latvia
VSL	Latvia €981,000
Currency	Euro
Time period (Years)	10
Benefit Cost Ratio	No cost data entered
Discount Rate	5%
Current Value of Annual Benefit	€2,507,000



Case study 3: Brasov, Romania

Overview
Brașov is the main urban centre in the central region of Romania, with a population of around 290,000. The Action Plan for Brasov sets out plans for a number of initiatives to promote cycling and walking across the city.

Introduction
One of the main issues that Brasov faces is lack of statistical data regarding physical activity in general, and cycling in particular. The SPACE project team therefore carried out a survey of cyclists, using an online questionnaire. This set out to find out how often people currently use the bicycle, for what purpose, and how much they say they would cycle if the infrastructure was improved.

The survey showed:

- cyclists ride for an average of 41 minutes, 4 days/week
- the main reason for cycling is transportation to the main daily points of interests (school, job, shopping etc)
- If the infrastructure was improved, cyclists say they would cycle for an average of 92 minutes/day and 6 days/week.

The project team thought that the results of this survey were somewhat optimistic and should be seen more as 'wishful thinking' that a strict reality. This is particularly in the light of the Sustainable Urban Mobility Plan (SUMP) developed for Brasov municipality by a consortium funded by European Bank for Reconstruction and Development (EBRD) and published in 2015. This showed 405,000 trips/day counted across the city, with only 0.2% of these being cycling trips - only 810 cycling trips/day. This conflicts with the local cyclists` association who estimate that 2,000-3,000 persons use the bicycle on a regular basis.

Although the survey we conducted was interesting, it does seem to represent an overestimate of the number of cyclists. It was notable that the respondents were mainly people who regularly use the bicycle (92% of the people who filled in the questionnaire). It was therefore decided to use the figures from the SUMP as it is an official document, approved by the local authority.

The mode share for cycling was used as the baseline (0.2% of trips) and then scenarios were calculated based on what it would be like if cycling in Brasov was like in other European cities. The action plan for Brasov has as vision: **Brasov - the city where cycling is a way of life**. Based on the pre-intervention available data and combined with the very ambitious vision that the people want to achieve, three different scenarios were developed:

1. ***What if the level of cycling in Brasov would be 2%*** (like in Bratislava)?
2. ***What if the level of cycling in Brasov would be 10.1%*** (like in Zagreb)?
3. ***What if the level of cycling in Brasov would be 32%*** (like in Amsterdam[3])?

3 https://ecf.com/resources/cycling-facts-and-figures

This produced the input data for the following HEAT calculations:
1. ***What if the level of cycling in Brasov would be 2%*** (like in Bratislava)?

HEAT estimate

Reduced mortality as a result of changes in cycling behaviour

The number of individuals cycling has increased between your pre and post data.
There are now 4,009 additional individuals regularly cycling, compared to the baseline.
However, the average amount of cycling per person per year has not changed.
The reported level of cycling in both your pre and post data gives a reduced risk of mortality of: 18% compared to individuals who do not regularly cycle.
You have chosen to assess the benefits of 50% of this change in reported levels of cycling.
Taking this into account, the number of deaths per year that are prevented by this change in cycling is: **1.60.**

Economic value of cycling

Currency: EUR, rounded to 1000

The value of statistical life applied is: **852,000 EUR**	
Based on a 5 year build up for benefits, a **3** year build up for uptake of cycling and an assessment period of **10** years:	
the average annual benefit, averaged over **10** years is:	**879,000 EUR**
the total benefits accumulated over **10** years are:	**8,791,000 EUR**
the maximum annual benefit reached by this level of cycling, per year, is:	**1,363,000 EUR**
This level of benefit is realised in year 9 when both health benefits and uptake of cycling have reached the maximum levels.	
When future benefits are discounted by 5% per year:	
the current value of the average annual benefit, averaged across 10 years is:	**626,000 EUR**
the current value of the total benefits accumulated over 10 years is:	**6,263,000 EUR**

If cycling in Brasov increased to the level in Bratislava (from 0.2% to 2% of all trips), this would save 1.6 lives per year. This is valued at €626,000 per year.

2. ***What if the level of cycling in Brasov would be 10.1%*** (like in Zagreb)?

HEAT estimate

Reduced mortality as a result of changes in cycling behaviour

The number of individuals cycling has increased between your pre and post data. There are now **22,275 additional** individuals regularly cycling, compared to the baseline. However, the average amount of cycling per person per year has not changed. The reported level of cycling in both your pre and post data gives a reduced risk of mortality of: **18%** compared to individuals who do not regularly cycle. You have chosen to assess the benefits of 50% of this change in reported levels of cycling. Taking this into account, the number of deaths per year that are prevented by this change in cycling is: **8.89.**

Economic value of cycling

Currency: EUR, rounded to 1000

The value of statistical life applied is: **852,000 EUR**
Based on a 5 year build up for benefits, a **3** year build up for uptake of cycling and an assessment period of 10 years:

the average annual benefit, averaged over **10** years is:	**4,884,000 EUR**
the total benefits accumulated over **10** years are:	**48,843,000 EUR**
the maximum annual benefit reached by this level of cycling, per year, is:	**7,573,000 EUR**

This level of benefit is realised in year 9 when both health benefits and uptake of cycling have reached the maximum levels.
When future benefits are discounted by 5% per year:

the current value of the average annual benefit, averaged across 10 years is:	**3,480,000 EUR**
the current value of the total benefits accumulated over 10 years is:	**34,799,000 EUR**

If cycling in Brasov increased to the level in Zagreb (from 0.2% to 10.1% of all trips), this would save 8.9 lives per year. This is valued at €3,480,000 per year.

3. ***What if the level of cycling in Brasov would be 32%*** (like in Amsterdam[4])? – at this point the vision will be achieved.

HEAT estimate

Reduced mortality as a result of changes in cycling behaviour

The number of individuals cycling has increased between your pre and post data. There are now **70,834 additional** individuals regularly cycling, compared to the baseline. However, the average amount of cycling per person per year has not changed.
The reported level of cycling in both your pre and post data gives a reduced risk of mortality of: 18% compared to individuals who do not regularly cycle.
You have chosen to assess the benefits of 50% of this change in reported levels of cycling. Taking this into account, the number of deaths per year that are prevented by this change in cycling is: **28.27.**

Economic value of cycling

Currency: EUR, rounded to 1000

The value of statistical life applied is: **852,000 EUR**
Based on a 5 year build up for benefits, a 3 year build up for uptake of cycling and an assessment period of 10 years:

the average annual benefit, averaged over **10** years is:	**15,532,000 EUR**
the total benefits accumulated over 10 years are:	**155,321,000 EUR**
the maximum annual benefit reached by this level of cycling, per year, is:	**24,081,000 EUR**

This level of benefit is realised in year 9 when both health benefits and uptake of cycling have reached the maximum levels.
When future benefits are discounted by 5% per year:

the current value of the average annual benefit, averaged across 10 years is:	**11,066,000 EUR**
the current value of the total benefits accumulated over 10 years is:	**110,659,000 EUR**

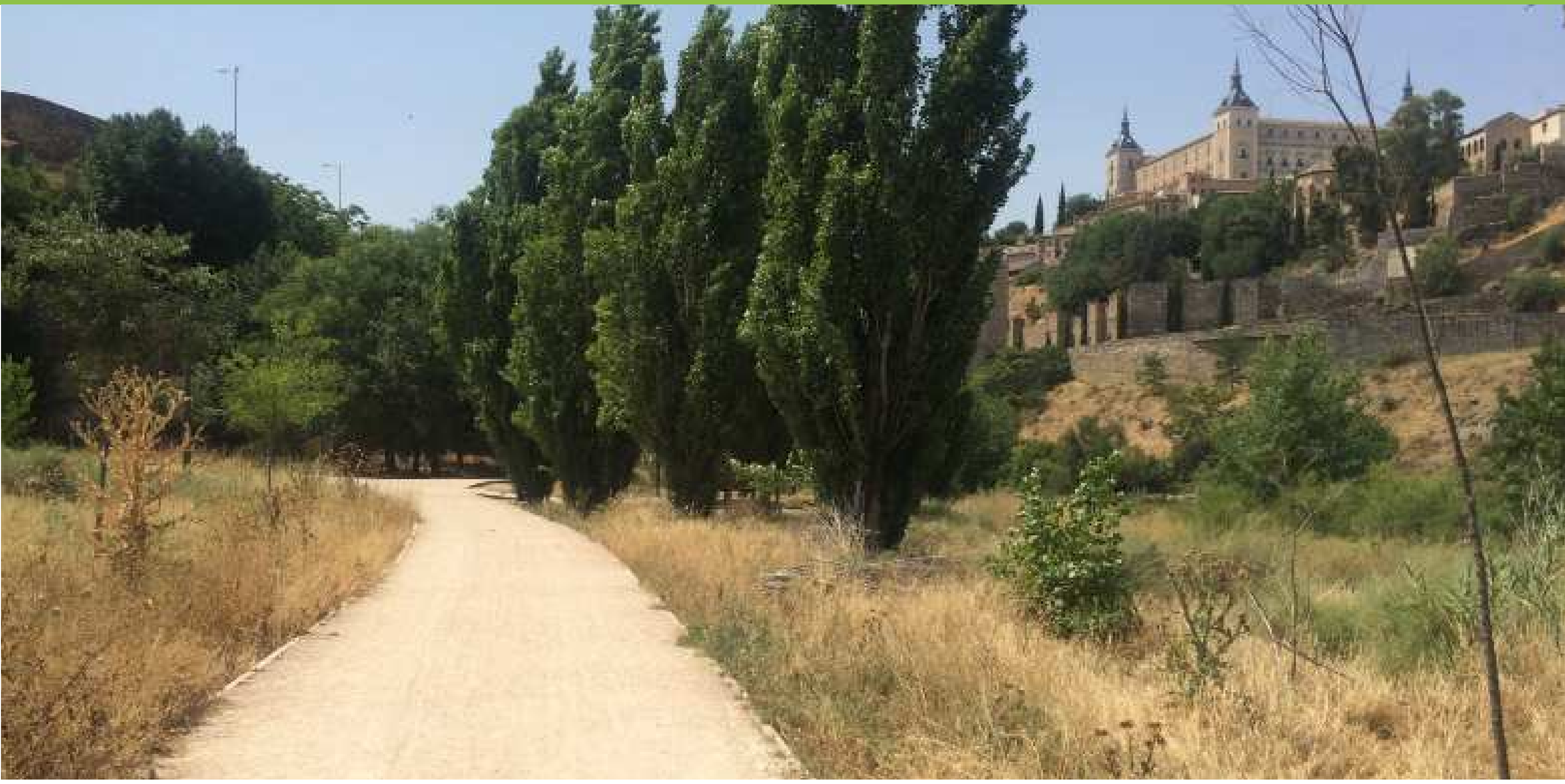
If cycling in Brasov increased to the level in Amsterdam (from 0.2% to 32% of all trips), this would save 28.3 lives per year. This is valued at €11,066,000 per year.

4 https://ecf.com/resources/cycling-facts-and-figures

Table 4: Step-by step HEAT specifications for Brasov case study

	Brasov			
	Baseline	Scenario One (Bratislava)	Scenario Two (Zagreb)	Scenario Three (Amsterdam)
Physical Activity Mode	Cycling	Cycling	Cycling	Cycling
Single Point of time/ Before After and Intervention	Before/after	Before/after	Before/after	Before/after
Type of Data	Trips	Trips	Trips	Trips
Average per Adult/ Total Number	Total Number	Total Number	Total Number	Total Number
Number of Trips Per Day	810 (0.2% of total 405,000)	8,100 (2% of total 405,000)	40,905 (10.1% of total 405,000)	129,600 (32% of total 405,000)
Proportion Trips Cycling Trips	100	100	100	100
Estimate No of Individuals	Based on return journeys	Based on return journeys	Based on return journeys	Based on return journeys
% return trips	90%	90%	90%	90%
Days per Year	124	124	124	124
Duration	41 minutes (from survey)	41 minutes (from survey)	41 minutes (from survey)	41 minutes (from survey)
How many people benefit	446 (Estimate Based on return journeys)	4009 extra	22,275 extra	70,834 extra

Current cycling or effects of intervention	Intervention	Intervention	Intervention	Intervention
Proportion of cycling attributable to intervention	50%	50%	50%	50%
Mortality Rate for Age range	Romania 20-64 years	Romania 20-64 years	Romania 20-64 years	Romania 20-64 years
VSL	Romania €851,697	Romania €851,697	Romania €851,697	Romania €851,697
Currency	Euro	Euro	Euro	Euro
Time period (Years)	10	10	10	10
Time taken to reach full cycling	3 years	3 years	3 years	3 years
Benefit Cost Ratio	None	None	None	None
Discount Rate	5%	5%	5%	5%
Current Value of Annual Benefit		€626,000	€3,480,000	€11,066,000



Case study 4: Toledo, Spain

Economic assessment of the health benefits of a new cycle path

Overview

Toledo is a municipality and a city in Spain, capital of the autonomic community of Castilla-La Mancha. It has around 83,000 citizens (2015) and it is the second most populated municipality in the province.

A major part of Toledo's action plan was focused on the building of a new cycle path from Toledo city to the Santa Mª de Benquerencia neighbourhood. The HEAT was therefore used to estimate the health benefits of the path, assuming different levels of usage. It also helped to compare the benfits to the cost of building the path (€400,000).

Background

The project team worked with Toledo Town Hall to find usable mobility data. The most recent data comes from the 2012 Toledo Sustainable Urban Mobility Plan.

Data collection and estimation

The Toledo Sustainability Urban Mobility Plan (PMUS) includes modelling analyses explaining the mobility, generation of trips and spatial distribution by different locations. A travel survey was conducted during October 2010, on both weekdays and weekend days. The analysis referred to trips between the old town of Toledo and the Santa Mª de Benquerencia neighbourhood. A breakdown of the number of trips by public transportation, private vehicle and others (including by bike and walking) is presented below.

This showed the following values for average daily trips in both directions:

	Daily Trips
Public transportation	6,660
Private transportation	18,000
Others	8,640
Total:	**33,300**

It is important to note that the results of these analyses are based on the number of global trips, and they are not based on the number of people that make a trip. So, on average, there are 33,300 trips between Toledo and Santa Mª de Benquerencia every day.
The HEAT calculation used the distance cycled of 4km as it represents the mean distance of all possible trips. The new cycle path links Santa Mª de Benquerencia to the train station, the biggest commercial centre in Toledo, the new hospital (still under construction) and some other social locations. Therefore, some people will use the cycle path to make a trip to some of these locations instead of cycling the whole cycle path.

The HEAT tool was used to estimate the health benefits of switching from some motorised transportation towards cycling. It was assumed that cyclists would ride on average on 124 days/year (as recommended in the HEAT) and that 90% of people would make a return journey.

The HEAT calculations are applied to three different scenarios:

a) A 5% of transportation switch from public or private transportation to biking.
b) A 10% of transportation switch from public or private transportation to biking.
c) A 20% of transportation switch from public or private transportation to biking.

a) A 5% of transportation switch from public or private transportation to biking.

HEAT estimate

Reduced mortality as a result of changes in cycling behaviour

The cycling data you have entered corresponds to an average of **901.82 km** per person per year.
This level of cycling provides **an estimated** protective benefit of: **7%** (compared to persons not cycling regularly).
From the data you have entered, the number of individuals who benefit from this level of cycling is: **916**.
Out of this many individuals, the number who would be expected to die if they were not cycling regularly would be: **1.86**
The number of deaths per year that are prevented by this level of cycling is: less than 1

Economic value of cycling

Currency: EUR, rounded to 1000

The value of statistical life applied is: **3,203,000 EUR**
Based on a **5** year build up for benefits, a 2 year build up for uptake of cycling and an assessment period of **10** years:

the average annual benefit, averaged over **10** years is:	**308,000 EUR**
the total benefits accumulated over **10** years are:	**3,083,000 EUR**
the maximum annual benefit reached by this level of cycling, per year,	**444,000 EUR**

This level of benefit is realised in year **8** when both health benefits and uptake of cycling have reached the maximum levels.
When future benefits are discounted by 5% per year:

the current value of the average annual benefit, averaged across 10 years is:	**222,000 EUR**
the current value of the total benefits accumulated over 10 years is:	**2,220,000 EUR**

Benefit-Cost Ratio

The total costs of:	**400,000 EUR**
Should produce a total saving over **10** years of:	**2,220,000 EUR**

Assuming 5 year build up of benefits, **2** years build up of uptake, and discounting of 5% per year

The benefit to cost ratio is therefore:	**5.55:1**

Achieving a 5% shift from public or private transportation to biking would save less than one life per year, valued at €222,000 per year. This results in a benefit:cost ratio of over 5:1.

b) A 10% of transportation switch from public or private transportation to biking.

HEAT estimate

Reduced mortality as a result of changes in cycling behaviour

The cycling data you have entered corresponds to an average of 901.82 km per person per year.
This level of cycling provides **an estimated** protective benefit of: **7%** (compared to persons not cycling regularly).
From the data you have entered, the number of individuals who benefit from this level of cycling is: **1832**.
Out of this many individuals, the number who would be expected to die if they were not cycling regularly would be: **3.73**
The number of deaths per year that are prevented by this level of cycling is: less than 1

Economic value of cycling

Currency: EUR, rounded to 1000

The value of statistical life applied is: **3,203,000 EUR**
Based on a 5 year build up for benefits, a **2** year build up for uptake of cycling and an assessment period of 10 years:

the average annual benefit, averaged over **10** years is:	**617,000 EUR**
the total benefits accumulated over **10** years are:	**6,166,000 EUR**
the maximum annual benefit reached by this level of cycling, per year, is:	**887,000 EUR**

This level of benefit is realised in year **8** when both health benefits and uptake of cycling have reached the maximum levels.

When future benefits are discounted by 5% per year:

the current value of the average annual benefit, averaged across 10 years is:	**444,000 EUR**
the current value of the total benefits accumulated over 10 years is:	**4,439,000 EUR**

Benefit-Cost Ratio

The total costs of:	**400,000 EUR**
Should produce a total saving over 10 years of:	**4,439,000 EUR**

Assuming 5 year build up of benefits, 2 years build up of uptake, and discounting of 5% per year

The benefit to cost ratio is therefore:	**11.10:1**

Achieving a 10% shift from public or private transportation to biking would save less than one life per year, valued at €444,000 per year. This results in a benefit:cost ratio of over 11:1.

c) A 20% of transportation switch from public or private transportation to biking.

HEAT estimate

Reduced mortality as a result of changes in cycling behaviour

The cycling data you have entered corresponds to an average of **901.82 km** per person per year.
This level of cycling provides **an estimated** protective benefit of: **7%** (compared to persons not cycling regularly).
From the data you have entered, the number of individuals who benefit from this level of cycling is: **3663**.
Out of this many individuals, the number who would be expected to die if they were not cycling regularly would be: **7.45**
The number of deaths per year that are prevented by this level of cycling is: less than 1

Economic value of cycling

Currency: EUR, rounded to 1000

The value of statistical life applied is: **3,203,000 EUR**
Based on a **5** year build up for benefits, a 2 year build up for uptake of cycling and an assessment period of **10** years:

the average annual benefit, averaged over **10** years is:	**1,223,000 EUR**
the total benefits accumulated over **10** years are:	**12,329,000 EUR**
the maximum annual benefit reached by this level of cycling, per year, is:	**1,774,000 EUR**

This level of benefit is realised in year 8 when both health benefits and uptake of cycling have reached the maximum levels.

When future benefits are discounted by 5% per year:

the current value of the average annual benefit, averaged across 10 years is:	**888,000 EUR**
the current value of the total benefits accumulated over 10 years is:	**8,876,000 EUR**

Benefit-Cost Ratio

The total costs of:	**400,000 EUR**
Should produce a total saving over **10** years of:	**8,876,000 EUR**

Assuming **5** year build up of benefits, **2** years build up of uptake, and discounting of 5% per year

The benefit to cost ratio is therefore:	**22.19:1**

Achieving a 20% shift from public or private transportation to biking would save less than one life per year, valued at €888,000 per year. This results in a benefit:cost ratio of over 22:1.

Use of the HEAT for Castilla-La Mancha regional government

These HEAT estimations have allowed Castilla-La Mancha regional government to reinforce the arguments for the promotion of active mobility projects. The HEAT health message can be added to the environmental messages that cycling helps reduces energy consumption; imporves air quality; reduces noise and improves wellbeing. The fact that HEAT uses an estimation in euros, makes it easier to understand for all citizens.

Table 5: Step-by step HEAT specifications for Toledo case study

	Toledo		
	Scenario One (5%)	**Scenario One (10%)**	**Scenario One (20%)**
Physical Activity Mode	Cycling	Cycling	Cycling
Single Point of time/ Before After and Intervention	Single Point	Single Point	Single Point
Type of Data	Trips	Trips	Trips
Average Distance	4000m	4000m	4000m
How many people benefit?	916	1832	3663
Days per Year	124	124	124
Current cycling or effects of intervention	Current cycling	Current cycling	Current cycling
Mortality Rate for Age range	Spain 20-64	Spain 20-64	Spain 20-64
Mortality Rate for Country	Spain	Spain	Spain
VSL for	Spain €3,202,968	Spain €3,202,968	Spain €3,202,968
Currency	Euro	Euro	Euro
Time period (Years)	10	10	10
Benefit Cost Ratio	Yes	Yes	Yes
Discount Rate	5%	5%	5%
Benefit	€2,220,000	€4,439,000	€8,876,000

Note: HEAT calculations for Scenarios 1, 2, & 3, used the Benefit - Cost function for HEAT Question 14. Cost for the development of the new cycle path (Q15) was estimated at €400,000

Case study 5: Palermo, Italy

Overview

Palermo is a city on the North West coast of Sicily, with a population around 1.2million. The UActivE Action Plan focuses on school children, with an aim to create a school culture that promotes active lifestyles among children and young people and supports the development of school environments that facilitate and increase regular physical activity, reducing inactivity and preventing childhood obesity.

Introduction

The town's action plan sets out plans to create a) School Urban Trails Programme - Urban trekking from home to school and b) Active School Districts.

The Plan has been developed as a strategy for the city of Palermo, supported by local government, academics, NGOs, enterprises and local communities towards realising a more healthy and activity-friendly city with increased physical activity levels among the local population.

An important part of the Plan is to advocate policies that will implement effective strategy and infrastructure to increase access to and encourage physical activity for all school children. Part of the advocacy approach could be stressing the economic benefits of investing in policies that help more people benefit their health through walking. Ideally this would have been based on data on the existing levels of walking in the Palermo area, and a projection of future increases. However, it was not possible to find reliable data on levels of cycling and walking in the City. Instead, a calculation was carried out based on a hypothetical increase, using population data.

Assessment of the economic impact of increased walking among whole population in Palermo

Although the Plan focuses on school age children it is important to note that the activities developed within it have an impact on the overall school community. Reviewing the wider school community that will involve parents, families and general population, available data shows that the adult population in Palermo aged 20-74 years old is approx. 470,000[5] (2016).

We then simply asked the question: 'what would be the benefits if every adult in Palermo walked for just ten minutes more per day'? This figure is hypothetical, but is also based on what might be seen to be a reasonable increase in walking.

HEAT estimate

Reduced mortality as a result of changes in walking behaviour

The walking data you have entered corresponds to an average of **10** minutes per person per day.

This level of walking provides **an estimated** protective benefit of: **5%** (compared to persons not walking regularly).

From the data you have entered, the number of individuals who benefit from this level of walking is: **470,000.**

Out of this many individuals, the number who would be expected to die if they were not walking regularly would be: 1,762

The number of deaths per year that are prevented by this level of walking is: 81

Economic value of walking

Currency: EUR, rounded to 1000

The value of statistical life of your population is:	**3,556,000 EUR**
The annual benefit, of this level of walking, per years is:	**287,144,000 EUR**
the total benefits accumulated over 10 years are:	**2,871,445,000 EUR**
When future benefits are discounted by 5% per year:	
the current value of the average annual benefit, averaged across 10 years is:	**221,725,000 EUR**
the current value of the total benefits accumulated over 10 years is:	**2,217,254,000 EUR**

Using the HEAT shows that if the adult population of Palermo walked for just 10 minutes extra every day, it would save 81 lives at a value of €222 million per year.

These results have been used by CESIE and will be used in the future with local partners to estimate cost/benefit for developing infrastructure for the promotion of walking.

5 https://www.citypopulation.de/php/italy-sicilia.php?cityid=082053

Table 6: Step-by step HEAT specifications for Palermo case study

	Palermo
Physical Activity Mode	Walking
Single Point of time/ Before After and Intervention	Single Point
Type of Data	Duration
Average time walking /minutes hours OR Average Distance	10 minutes
Days per Year	Not needed (average per day)
How many people benefit	470,000
Current walking or effects of intervention	All current walking
Mortality Rate for Age range	20-74
Mortality Rate for Country	Italy
VSL	Italy €3,555,826
Currency	Euro
Time period (Years)	10
Benefit Cost Ratio	No cost data entered
Discount Rate	5%
Current Value of Annual Benefit	€2,217,254

Discussion

The objective of this document is to describe and explain how SPAcE project partners understand the HEAT; to integrate it into their action plans; and to use it in their case study sites to help advance their plans for walking and cycling.

As the case studies have shown, there are various ways that HEAT can be used to estimate the economic impact of increased walking and cycling, and different approaches to how this information can be applied in practice. In all five of the SPACE case studies, projections were carried out, as the projects had not begun any work in increasing cycling and walking. These calculations were therefore used as part of general efforts to advocate for more cycling and walking, and specifically to secure funding. While it is impossible to separate the specific impact that these calculations had on funding decisions, in all cases the SPACE partners said the process and the resulting calculations were helpful.

The application of HEAT within the project was not without problems however. Many of the SPACE partners at first had significant difficulties working with the HEAT, and some required considerable assistance throughout. In some ways this is not surprising as the SPACE partners were in the main not transport planners or economists. However, it should be borne in mind that the HEAT team have worked hard to make the HEAT as easy to use as possible. The project has shown that these efforts to increase usability of the HEAT need to continue if it is to be used by the widest range of possible recipients. A revised version of HEAT launched in fall 2017 has already taken into account some of this feedback from the SPAcE project. However, it should be borne in mind that the WHO HEAT team have worked hard to make the HEAT as easy to use as possible. The project has shown that these efforts to increase usability of the HEAT need to continue if it is to be used by the widest range of possible recipients. A revised version of HEAT launched in fall 2017 has already taken into account some of this feedback from the SPAcE project.

The main barrier faced by SPACE partners was finding the data to input to the HEAT, or in converting it into the right format so that it could be used in the HEAT. Most of the SPACE partners faced a lack of local data on walking and cycling, and had to conduct their own small surveys. In some cases these produced quite unreliable estimates. Others faced problems in translating standard data from travel surveys into the format that could be used for the HEAT. There is clearly a need for ongoing training in this issue, and for promoting the integration of walking and cycling into standard transport surveys locally as well as on a national and international level.

In summary, the HEAT was a useful aspect of the SPACE project, but it was more difficult to implement than first thought when the project was in its development stages. More standardized data on walking and cycling, and more training and assistance for HEAT users is needed in the future.

Further examples

Cavill N, Rutter H, & Gower, R. (2014). Economic assessment of the health benefits of walking on the Wales Coast Path. Natural Resources Wales.
http://www.walescoastpath.gov.uk/media/1143/economic-assessment-of-the-health-benefits-of-walking-on-the-wales-coast-path.pdf

This study conducted an economic assessment of the health benefits arising from people walking the Wales Coast Path. On pages 8-11, a detailed description of the estimations and inputs to HEAT is provided.

Bike Safe: Student consultancy report (2013).
http://www.b4044path.org/wp-content/uploads/2013/07/B4044-Community-Path-Cost-benefit-assessment-report-Jun13.pdf

This study conducted a projection of the health and economic benefits of the construction of a multipurpose community path built between Eynsham and Botley, Oxford, UK. On pages 5-6, a detailed description of the assumptions, inputs and estimations is provided.

Additional examples are also given at http://www.heatwalkingcycling.org

Photo Credits

Case study 1: Trikala, Greece.

Page 11: Thanos, Floulis & Yiannis, Floulis. September 2016, Cycling at Trikala.

Case study 2: Tukums, Latvia.

Page 16: Kubiliusa, Anda. 23 April 2016, Bicycle parking spots near by the school.

Case study 3: Brasov, Romania

Page 20: Paul, Andrei. Bicyclists: critical mass.

Case study 4: Toledo, Spain.

Page 27: Aznar, Susana. Beginning of the cycle path. Existing path from old town.

Case study 5: Palermo, Italy

Page 33: Giuliana, Marianna. June 2017, Via Maqueda pedestrian zone and cycle path.

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www.uth.gr/en

University of Zurich
Switzerland
www.ebpi.uzh.ch/en.html

Fit for Life Program, LIKES – Foundation for Physical Activity and Public Health sr.
Finland
www.kkiohjelma.fi

Castilla la Mancha Regional Government of Education, Culture and Sport
Spain
www.castillalamancha.es

Tukums Municipality
Latvia
www.tukums.lv

Brasov Metropolitan Agency for Sustainable Development
Romania
www.metropolabrasov.ro

CESIE
Italy
www.cesie.org

Municipality of Trikala
Greece
www.trikalacity.gr

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